Astronomy and Astrophysics 2016 vol.594

Planck 2015 results: XXIII. The thermal Sunyaev-Zeldovich effect-cosmic infrared background correlation

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Abstract

© 2016 ESO.We use Planck data to detect the cross-correlation between the thermal Sunyaev-Zeldovich (tSZ) effect and the infrared emission from the galaxies that make up the the cosmic infrared background (CIB). We first perform a stacking analysis towards Planck-confirmed galaxy clusters. We detect infrared emission produced by dusty galaxies inside these clusters and demonstrate that the infrared emission is about 50% more extended than the tSZ effect. Modelling the emission with a Navarro-Frenk-White profile, we find that the radial profile concentration parameter is c500 = 1.00+0.18-0.15 c500=1.00-0.15+0.18. This indicates that infrared galaxies in the outskirts of clusters have higher infrared flux than cluster-core galaxies. We also study the cross-correlation between tSZ and CIB anisotropies, following three alternative approaches based on power spectrum analyses: (i) using a catalogue of confirmed clusters detected in Planck data; (ii) using an all-sky tSZ map built from Planck frequency maps; and (iii) using cross-spectra between Planck frequency maps. With the three different methods, we detect the tSZ-CIB cross-power spectrum at significance levels of (i) 6σ; (ii) 3σ; and (iii) 4σ. We model the tSZ-CIB cross-correlation signature and compare predictions with the measurements. The amplitude of the cross-correlation relative to the fiducial model is AtSZ-CIB = 1.2 ± 0.3. This result is consistent with predictions for the tSZ-CIB cross-correlation assuming the best-fit cosmological model from Planck 2015 results along with the tSZ and CIB scaling relations.

http://dx.doi.org/10.1051/0004-6361/201527418

Keywords

Galaxies: clusters: general, Infrared: galaxies, Large-scale structure of Universe, Methods: data analysis